We claim:

1. A waveguide system for propagating light signals comprising:

a substrate;

a first waveguide adapted to propagate a first light signal, the first waveguide having a first waveguide portion, the first waveguide portion running in a first direction on a first plane relative to the substrate;

a second waveguide adapted to propagate a second light signal, the second waveguide having a second waveguide portion, the second waveguide portion running in a second direction on the first plane, the second direction being different than the first direction; and

a third waveguide having a third waveguide portion, the third waveguide portion lying in a second plane, the second plane being different than the first plane, the third waveguide portion being directionally coupled with the second waveguide portion to propagate the second light signal from the second waveguide portion into the third waveguide portion.

2. The waveguide system of claim 1, wherein the second plane is parallel to the first plane.

3. The waveguide system of claim 2, wherein the first plane is parallel to the substrate and lies between the substrate and the second plane.

4. The waveguide system of claim 1, wherein the first direction is substantially perpendicular to the second direction.

5. The waveguide system of claim 2, wherein the first direction is substantially perpendicular to the second direction.

6. The waveguide system of claim 1, wherein the third waveguide portion is directionally coupled to the second waveguide portion over a coupling length that achieves full or substantially near full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

7. The waveguide system of claim 6, wherein the coupling length achieves full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

8. The waveguide system of claim 1, wherein the third waveguide portion is directionally coupled to the second waveguide portion over a coupling length that achieves at least 90% of full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

9. The waveguide system of claim 1, wherein the third waveguide portion is directionally coupled to the second waveguide portion over a coupling length that achieves at least 75% of full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

10. The waveguide system of claim 6, wherein the coupling length depends on the characteristics of the second waveguide portion, the characteristics of the third waveguide portion, the separation

between the second waveguide portion and the third waveguide portion, and the wavelength of the second light signal.

11. The waveguide system of claim 6, wherein the second plane is parallel to the first plane.

12. The waveguide system of claim 11, wherein the first plane is parallel to the substrate and lies between the substrate and the second plane.

13. The waveguide system of claim 6, wherein the first direction is substantially perpendicular to the second direction.

14. The waveguide system of claim 11, wherein the first direction is substantially perpendicular to the second direction.

15. The waveguide system of claim 12, wherein the third waveguide portion is directionally coupled to the second waveguide portion over a coupling length that achieves full or substantially near full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

16. The waveguide system of claim 15, wherein the coupling length achieves full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

17. The waveguide system of claim 12, wherein the third waveguide portion is directionally coupled to the second waveguide portion over a coupling length that achieves at least 90% of full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

18. The waveguide system of claim 12, wherein the third waveguide portion is directionally coupled to the second waveguide portion over a coupling length that achieves at least 75% of full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

19. The waveguide system of claim 15, wherein the coupling length depends on the characteristics of the second waveguide portion, the characteristics of the third waveguide portion, the separation between the second waveguide portion and the third waveguide portion, and the wavelength of the second light signal.

20. The waveguide system of claim 1, wherein the substrate is a semiconductor substrate.

21. The waveguide system of claim 12, wherein the substrate is a semiconductor substrate.

22. The waveguide system of claim 1, further comprising:

a fourth waveguide having a fourth waveguide portion, the fourth waveguide portion running in a fourth direction on the first plane, the fourth direction being different than the first direction; and

the third waveguide having a fifth waveguide portion, the fifth waveguide portion lying in the second plane, the fifth waveguide portion being directionally coupled with the fourth waveguide portion to propagate the second light signal from the fifth waveguide portion into the fourth waveguide portion.

23. The waveguide system of claim 22, wherein the second plane is parallel to the first plane.

24. The waveguide system of claim 23, wherein the first plane is parallel to the substrate and lies between the substrate and the second plane.

25. The waveguide system of claim 22, wherein the fourth direction is substantially parallel to the second direction.

26. The waveguide system of claim 25, wherein the fourth direction is substantially perpendicular to the first direction.

27. The waveguide system of claim 22, wherein the fourth and fifth waveguide portions are directionally coupled over a coupling length that achieves full or substantially near full coupling of the second light signal from the fifth waveguide portion to the fourth waveguide portion.

28. The waveguide system of claim 27, wherein the coupling length achieves full coupling of the second light signal from the fifth waveguide portion to the fourth waveguide portion.

29. The waveguide system of claim 22, wherein the fourth and fifth waveguide portions are directionally coupled over a coupling length that achieves at least 90% of full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

30. The waveguide system of claim 22, wherein the fourth and fifth waveguide portions are directionally coupled over a coupling length that achieves at least 75% of full coupling of the second light signal from the second waveguide portion to the third waveguide portion.

31. The waveguide system of claim 22, wherein the substrate is a semiconductor substrate.

32. A method of making a waveguide network for propagating light signals, the method comprising:

depositing a first cladding layer on a substrate;

depositing a first core layer on the first cladding layer, the first core layer having a higher index than the first cladding layer;

etching the first core layer to form a first waveguide core and a second waveguide core;

depositing and planarizing a second cladding layer;

depositing a second core layer on the second cladding layer;

etching the second core layer to form a bridge waveguide core; and

depositing a third cladding layer.

33. The method of claim 32 wherein the step of etching the second core layer forms the bridge waveguide core to be directionally coupled to the first waveguide core over a coupling length to propagate a light signal from the first waveguide core to the bridge waveguide core.

34. The method of claim 32 wherein the bridge waveguide core runs in a direction substantially parallel to the first waveguide core.

35. The method of claim 32 wherein the first waveguide core runs in a different direction than the second waveguide core.

36. The method of claim 35 wherein the bridge waveguide core runs in a direction substantially parallel to the first waveguide core.

37. The method of claim 35 wherein the first waveguide core runs substantially perpendicular to the second waveguide core.

38. The method of claim 32, wherein the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the first waveguide core over a coupling length that achieves full or substantially near full coupling of a light signal from the first waveguide core to the bridge waveguide core.

39. The method of claim 38, wherein the coupling length permits full coupling of the light signal from the first waveguide core to the bridge waveguide core.

40. The method of claim 32, the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the first waveguide core over a coupling length that achieves at least 90% of full coupling of a light signal from the first waveguide core to the bridge waveguide core.

41. The method of claim 32, the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the first waveguide core over a coupling length that achieves at least 75% of full coupling of a light signal from the first waveguide core to the bridge waveguide core.

42. The method of claim 32 wherein the step of etching the first core layer forms a first waveguide core, a second waveguide core, and a third waveguide core.

43. The method of claim 42 wherein the first waveguide core and third waveguide core are substantially parallel to each other.

44. The method of claim 42 wherein the second waveguide core is substantially perpendicular to the first and third waveguide cores.

45. The method of claim 42 wherein the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the third waveguide core over a coupling length that achieves full or substantially near full coupling of a light signal from the bridge waveguide core to the third waveguide core.

46. The method of claim 45, wherein the coupling length permits full coupling of the light signal from the first waveguide core to the bridge waveguide core.

47. The method of claim 42, the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the third waveguide core over a coupling length that achieves at least 90% of full coupling of a light signal from the bridge waveguide core to the third waveguide core.

48. The method of claim 42, the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the third waveguide core over a coupling length that achieves at least 75% of full coupling of a light signal from the bridge waveguide core to the third waveguide core.

49. The method of claim 38 wherein the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the third waveguide core over a coupling length that achieves full or substantially near full coupling of a light signal from the bridge waveguide core to the third waveguide core.

50. The method of claim 40, the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the third waveguide core over a coupling length that achieves at least 90% of full coupling of a light signal from the bridge waveguide core to the third waveguide core.

51. The method of claim 41, the step of etching the second cladding layer forms the bridge waveguide core to be directionally coupled to the third waveguide core over a coupling length that achieves at least 75% of full coupling of a light signal from the bridge waveguide core to the third waveguide core.